Total Maximum Daily Load
Implementation Strategies

for

Spring Creek
Dent County

Impairments: Low Dissolved Oxygen and Organic sediment

Prepared by: Water Protection Program, Watershed Protection Section

WATER BODY SUMMARY

Pollutants: Low dissolved oxygen and Organic Sediment

Name: Spring Creek[1]
Location: Dent County near Salem

8-digit Hydrologic Unit Code (HUC):[2]
07140102 – Meramec

12-digit HUC Subwatersheds:
071401020103 – Spring Creek

Water Body Identification Number (WBID) and Hydrologic Class:[3]
WBID 1870[4] – Class P

Designated Uses:[5]
Irrigation
Livestock and wildlife protection
Human health protection
Warm water habitat (aquatic life)
Whole body contact recreation category B
Secondary contact recreation

Impaired Use:
Warm water habitat (aquatic life)

Pollutants Identified on the 2008 303(d) List:
Low dissolved oxygen
Organic sediment

Identified Source on the 2008 303(d) List:
Point/NPS

Length and Location of Spring Creek, WBID 1870:
12.7 miles (20.4 kilometers), from SR-32 in SE Salem to Section 32, Township 35N, Range 06W

[1] The 2008 303(d) List of impaired waters incorrectly identified this water body as Spring Branch (Creek).

[2] The U.S. Geological Survey uses a nationwide system based on surface hydrologic features to delineate watersheds. This system divides the country into 2,270 8-digit hydrologic units (USGS and NRCS 2013). A hydrologic unit is a drainage area delineated to nest in a multilevel, hierarchical drainage system. A hydrologic unit code is the numerical identifier of a specific hydrologic unit consisting of a 2-digit sequence for each specific level within the delineation hierarchy (FGDC 2003).

[3] For hydrologic classes see 10 CSR 20-7.031(1)(F). Class P streams maintain permanent flow even in drought periods.

[4] The 2008 303(d) List incorrectly identified the WBID for Spring Creek as 3708.

[5] For designated uses see 10 CSR 20-7.031(1)(C) and 10 CSR 20-7.031 Table H. Presumed uses are assigned per 10 CSR 20-7.031(2)(A) and (B) and are reflected in the Missouri Use Designation Dataset described at 10 CSR 20-7.031(2)(E).

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1. Introduction

A total maximum daily load (TMDL) identifies water quality problems, possible causes of those problems, and provides targets for restoration. However, actual water quality improvements are often dependent upon voluntary actions and support from local communities and landowners residing within the watershed. This implementation strategies document is a companion to the TMDL report and provides supplemental information about actions that will implement the goals established to attain water quality standards in Spring Creek. These strategies provide a general guide to permit writers, nonpoint source program coordinators, and other Missouri Department of Natural Resources staff, as well as soil and water conservation districts, local governments, permitted entities, regional planning commissions, watershed managers, and citizen groups for achieving the wasteload and load allocations established in the TMDL. Reducing current pollutant loading to the allocations established in the TMDL will result in the water body attaining its designated warm water habitat use for the protection of aquatic life. In this way, the TMDL serves as a "pollutant diet" for maintaining the environmental health of the stream. Figure 1 presents the location of the impaired water body and its watershed. General background and watershed information for Spring Creek can be found in the TMDL revision. The revised TMDL document is available on the Department's website at dnr.mo.gov/water/what-were-doing/water-planning/quality-standards-impaired-waters-total-maximum-daily-loads/tmdls . Questions regarding the TMDL may be sent via email to tmdl@dnr.mo.gov or by calling the Department's Watershed Protection Section at 573-751-5723.

The purpose of this document is to provide information about the strategies that may be implemented to achieve TMDL targets. However, this document neither prescribes nor prohibits any specific practices or technologies for reducing pollutant loading in the impaired water body and is not intended to serve as the sole means of remediation and restoration. The Department recognizes that technical guidance and support are critical to achieving the goals of any TMDL. Therefore, while a TMDL calculates the maximum pollutant loading that the impaired stream can assimilate and still meet water quality standards, this strategies document provides information about best management practices, treatment technologies, potential participants in the watershed, funding sources, and calculations of pollutant reductions.

Because the TMDL addresses pollutant loading from all potential sources in the watershed, this strategies document provides guidance for meeting the established loading targets assigned to both point and nonpoint sources.[6] The federal Clean Water Act regulates point sources of pollution. Any necessary reductions in pollutant loading from these sources are completed through the Missouri State Operating Permit program. Nonpoint sources of pollution are not regulated through permits and any reductions from these sources will rely on the voluntary implementation of best management practices (BMPs) in the watershed. Local communities and citizens looking to develop organized watershed groups to improve water quality are encouraged to contact the University of Missouri Extension at 573-882-0085. Information regarding the University Extension's water quality program is available online at https://extension.missouri.edu/find-your-interest/agriculture-and-environment/agricultural-systems-and-natural-resources/soil-and-water/water-quality.

[6] Point and nonpoint sources are defined and discussed in Sections 3.1 and 3.2 of the 2010 Spring Creek TMDL. Specific water quality goals associated with these sources are found in the TMDL revision.

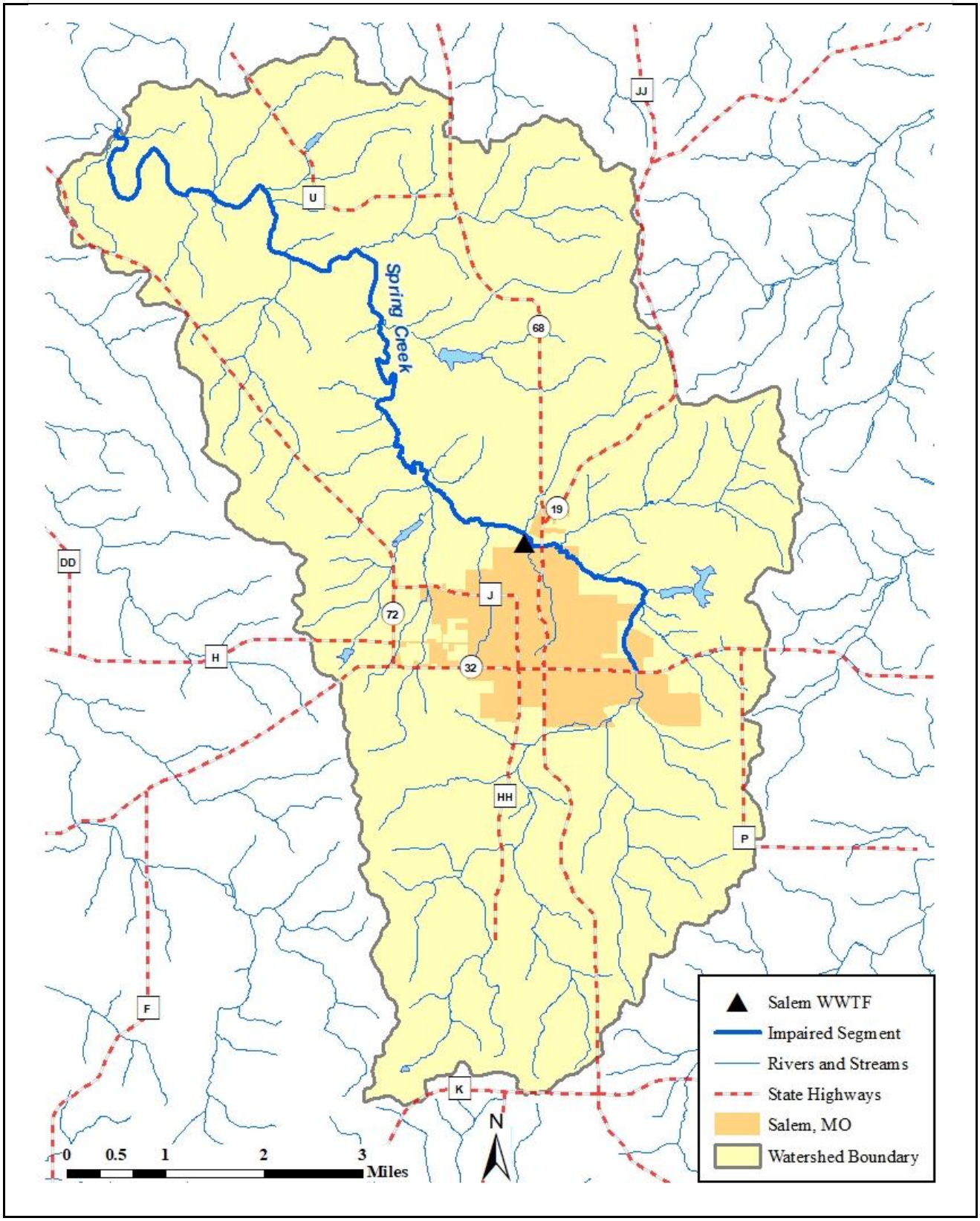

Figure 1. The Spring Creek watershed

2. Targeted Participants and Potential Roles in Implementation

The Department implements TMDL targets for point sources through the Missouri State Operating Permit program. For nonpoint sources, private landowners and citizen groups voluntarily implement water quality improving projects and cost-share practices which may be funded in part by grants or subgrants from the Department's Section 319 Nonpoint Source Implementation Program and the Soil and Water Conservation Program. Local governments, citizen groups, and individuals who have an interest in improving water quality in their communities may implement additional water quality improving actions. Successfully meeting the goals of the TMDL requires participation and cooperation from the various parties within the watershed. Participant roles range from technical support to actual on-the-ground implementation of BMPs. Groups and agencies that may potentially be involved in the TMDL implementation process are identified below along with descriptions of their possible roles. This list is not exhaustive and not intended to compel participation from any organizations; nor is it meant to exclude those who are not listed, but may be interested in participating.

- Department of Natural Resources
  - Administers statutory authorities granted by Missouri clean water law
  - Ensures permits issued in the watershed are consistent with the assumptions and requirements of TMDL wasteload allocations (the allowable point source load)
  - Provides compliance assistance to regulated entities
  - Provides technical support to locally-led watershed groups
  - Serves as a potential source of financial assistance for watershed plan development and BMP implementation through Sections 319(h) and 604(b) grants, or through Soil and Water Program cost-share practices
  - Serves as a potential source of financial assistance for infrastructure improvements through low-interest State Revolving Fund loans
  - Assesses attainment of water quality standards on a biennial basis for Clean Water Act Sections 303(d) and 305(b) reporting
  - Provides education and training to volunteers through the Missouri Stream Team Program[7]
- County Soil and Water Conservation Districts
  - Provide financial incentives to agricultural producers to implement conservation practices that help prevent soil erosion and protect water quality
  - Provide technical assistance with design, implementation, and maintenance of conservation practices
- University of Missouri Extension
  - Provides technical assistance for addressing nonpoint source and watershed management issues
  - Assists with organizing locally led watershed groups
- Missouri Department of Conservation
  - Provides technical assistance with stream and watershed management issues
  - Promotes maintenance and reestablishment of stable streambanks and functional riparian corridors

[7] The Missouri Stream Team Program is a partnership between the Department of Natural Resources, the Department of Conservation, the Conservation Federation of Missouri, and the citizens of Missouri. The Stream Team Program provides an opportunity for all citizens to get involved in river conservation. Additional information regarding the Stream Team program is available online at mostreamteam.org.

- Missouri Department of Health and Senior Services
  - Provides technical assistance pertaining to onsite wastewater treatment systems
- County Health Departments
  - Provide technical assistance pertaining to onsite wastewater treatment (i.e., septic) systems
- Municipal and domestic wastewater facilities
  - Implement biological nutrient removal or enhanced nutrient removal technologies as needed
  - Discharge treated wastewater in accordance with applicable permit limits associated with nutrients, total suspended solids (TSS), and biochemical oxygen demand
- Locally led watershed groups
  - Develop and implement Section 319-funded nine key element watershed-based plans.[8] (See Appendix A)
  - Identify critical areas at a local level
  - Implement BMPs
  - Provide public education and outreach
- Stream Team volunteers
  - Collect screening level water quality data (i.e., dissolved oxygen and biological monitoring) through the Volunteer Water Quality Monitoring program
  - Provide stewardship, advocacy, and education
- Citizens living and working within the watershed
  - Voluntarily implement structural and nonstructural BMPs on private lands, residences, and businesses, such as limiting fertilizer use, maintaining septic systems, conserving water, controlling erosion, limiting runoff, and managing manure

3. Why is a TMDL Needed for Spring Creek?

Section 303(d) of the federal Clean Water Act and Title 40 of the Code of Federal Regulations Part 130 require states to develop TMDLs for water bodies not meeting applicable water quality standards. Missouri's Water Quality Standards consist of three major components: designated uses, water quality criteria, and an antidegradation policy. Descriptions of each of these components can be found in the revised TMDL. Spring Creek is not attaining designated aquatic life protections for warm water habitats due to violations of Missouri's dissolved oxygen criterion. The applicable numeric criterion for dissolved oxygen in Spring Creek is a minimum 5 milligrams per liter (mg/L). Values less than this value endanger the health of aquatic life.

4. Review of Sources Identified in the TMDL Report

Section 6 of the revised TMDL contains a comprehensive inventory and assessment of all known and suspected sources in the watershed of pollutants that may contribute to low dissolved oxygen conditions in Spring Creek. The sources identified in the TMDL are based on issued permits and a general knowledge of watershed conditions. Specific loading contributions from each source are not always known; therefore, groups interested in implementing BMPs in the watershed may want to consider employing additional data collection efforts such as edge-of-field monitoring or sediment studies. See Table 1 for a list of the potential sources identified in the TMDL report. Although these sources were identified as potential contributors of pollutants to Spring Creek, the TMDL provides additional information regarding the significance of these contributions to the impaired segment.

[8] Guidance for developing a successful watershed-based plan that incorporates the U.S. Environmental Protection Agency's nine minimum elements is available online at www.epa.gov/nps/handbook-developing-watershed-plans-restore-and-protect-our-waters. These nine elements are required for plans funded with incremental Clean Water Act section 319 funds and are recommended for inclusion in all other watershed plans.

Table 1. Potential sources contributing to low dissolved oxygen conditions in Spring Creek

Point Sources	Nonpoint Sources

• City of Salem Wastewater Treatment Facility
  ○ Treated domestic wastes (nutrients and organics)
  ○ Bypasses or sanitary sewer overflows
• Illicit straight pipe dischargers
  ○ Untreated domestic wastes (nutrients and organics)
	• Onsite wastewater treatment system failures
	  ○ Untreated or partially treated domestic wastes
	• Urban stormwater runoff
	  ○ Lawn fertilizers; compost; pet and wildlife wastes
	• Agricultural stormwater runoff
	  ○ Fertilizers; livestock and wildlife wastes
	• Riparian conditions
	  ○ Lack of canopy (shade)
	  ○ Leaf litter (nutrients)
	  ○ Lack of vegetation (erosion)

5. Existing Loads and Needed Reductions

Current pollutant loading to an approximately 7.4 miles stretch of Spring Creek, as depicted in Figure 1, results in conditions that reduce dissolved oxygen concentrations in the stream to levels that harm aquatic life. Organic sediment loading from the Salem Wastewater Treatment Facility was also cited as contributing to the impairment when the stream was originally identified as impaired on the 1994 303(d) List. To address the water quality impairment in Spring Creek, TMDL loading targets were developed for various pollutants known to contribute to low dissolved oxygen conditions, such as biochemical oxygen demand (BOD), ammonia as nitrogen, and nutrients. The TMDL also included targets for TSS to address sediment loading in the stream. Reducing current pollutant loads to the loads specified in the TMDL will result in attainment of water quality standards. The revised TMDL provides loading targets at low flow conditions when dissolved oxygen impairments are likely to occur. This loading represents reductions from point sources in the watershed as well as reductions in pollutant loading from nonpoint sources. Additionally, a TSS concentration value of 5 mg/L is targeted at all flows from all areas contributing to the 7.4 mile-long impairment in Spring Creek.

6. Implementation of the TMDL

TMDLs provide useful information for setting water quality goals and determining appropriate actions for pollutant reductions. Progress towards meeting water quality standards is expected to be long-term. In general, initial TMDL implementation is typically a continuation of already existing or planned activities, such as permits or Soil and Water Conservation Program cost-share practices. Except in cases where activities and schedules are required by legally binding requirements, such as established permit conditions, an adaptive implementation approach that makes progress toward achieving water quality goals while using new data and information to reduce uncertainty and adjust implementation activities should be used.

6.1 Point Source Implementation

Federal regulations at 40 CFR §122.44(d)(1)(vii)(B) require permit conditions to be consistent with the assumptions and requirements of TMDL wasteload allocations. How these conditions are expressed can vary depending upon the pollutant and nature of the discharge. Although TMDLs are required to be written for daily time increments, permit effluent limits may be written in a form that derives from and complies with applicable water quality standards that use any time measure (40 CFR 122.44(d)(1)(vii)(A) and EPA 2006). The Department's permit writers have discretion for how TMDL wasteload allocations are expressed in a permit and for determining appropriate implementation schedules. Permit writers should consult available permit writing handbooks and

technical support documents to determine appropriate limits.[9] Although wasteload allocations are often specified for individual facilities, in some cases, it may be appropriate for pollutant loadings to be shifted between the individual facilities during permitting as long as the sum of the wasteload allocations remains unchanged and is not exceeded (EPA 2012). In no case does a TMDL wasteload allocation allow for permit limits that exceed water quality standards. If water quality standard revisions result in criteria more stringent than an established TMDL wasteload allocation, then the more stringent criteria should be used in deriving the permit limits.[10] Information regarding the Department's permitting process is available online at dnr.mo.gov/water/business-industry-other-entities/permits-certification-engineering-fees/wastewater or by calling the Department's Operating Permit Section at 573-522-4502.

Table 2 lists the types of point sources in the Spring Creek watershed that should be addressed in order to achieve the TMDL wasteload allocation targets. As noted in the TMDL, the city of Salem Wastewater Treatment Facility discharges treated wastewater that contains nutrients, organic material, and oxygen demanding substances that can contribute to low dissolved oxygen conditions, and is the primary point source contributor to the impairment during critical low flow conditions. Therefore, limiting pollutant concentrations to those consistent to meet the specified wasteload allocations identified in the revised TMDL will result in attainment of water quality standards. At the request of the City of Salem in comments they provided on July 16, 2020, a critical condition model was also developed to reflect a potential expansion of the Salem Wastewater Treatment Facility from 0.741 MGD to 1.1 MGD. At this time the Department has not received any applications for this expansion. The TMDL wasteload allocations are based on the current design flow, but this secondary model indicates that wasteload allocation concentrations at these higher flows will attain the dissolved oxygen criterion (Figure 2). Attainment of the minimum dissolved oxygen criterion is the ultimate goal of the TMDL. Should water quality standards be attained before all pollutant wasteload allocations have been achieved, then no additional pollutant reductions will be required. Pollutant reductions from the wastewater treatment facility can be achieved through enhanced treatment technologies. Other point sources in the watershed that are not specifically allocated a portion of the total loading capacity should continue to operate in compliance with existing permit limits and conditions. This will maintain pollutant loading from these sources at existing concentrations, which is expected to be protective of water quality standards and does not cause or contribute to the low dissolved oxygen impairment of Spring Creek. Any unpermitted illicit straight pipe dischargers in the watershed are illegal and must be eliminated.

Table 2. TMDL implementation for point sources in the Spring Creek watershed

Point Source	Objective	Strategies
Salem Wastewater Treatment Facility (domestic wastewater)	Meet TSS, BOD, nitrogen, and phosphorus wasteload allocation targets stated in the revised TMDL.	• Consider no discharge options • Biological nutrient removal • Reduce occurrences of sanitary sewer overflows
Other permitted point sources	Maintain existing pollutant loadings	• Maintain compliance with existing permit limits and conditions • Water quality trading
Illicit straight pipe discharges	Illegal discharges and therefore must be eliminated from the watershed	• Report known discharges to local county health departments

[9] The EPA maintains a National Pollutant Discharge Elimination System (NPDES) Permit Writers' Manual online at epa.gov/npdes/npdes-permit-writers-manual.

[10] Federal regulations at 40 CFR 131.21, also known as the "Alaska Rule," require water quality standards to be approved by the EPA before they can be used for Clean Water Act purposes (i.e., water quality-based effluent limitations or TMDLs).

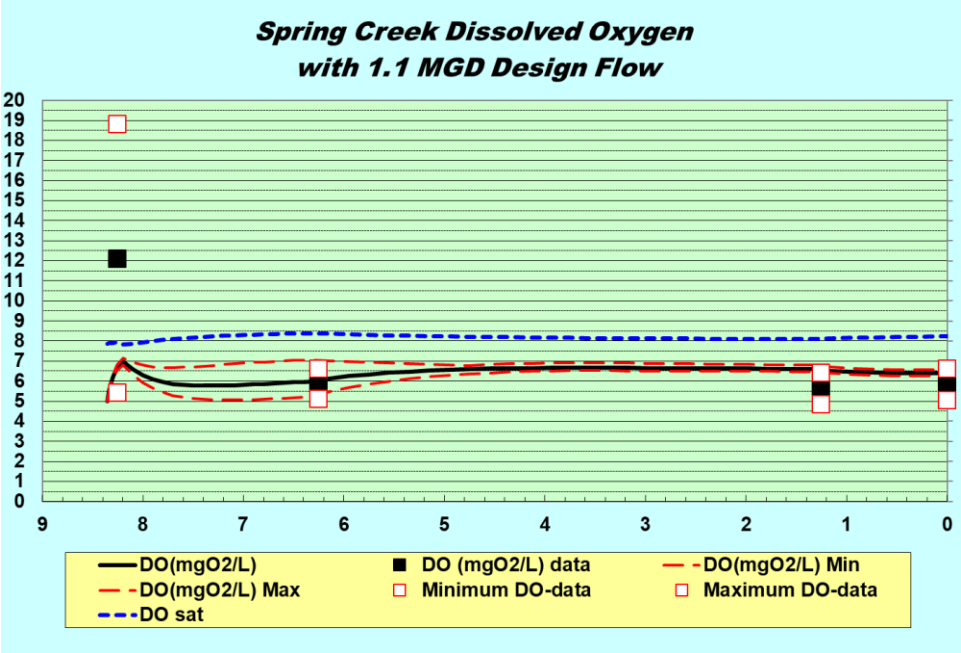

Figure 2. QUAL2K Expanded Discharge Model – Dissolved Oxygen

6.2 Nonpoint Source Implementation

The Department does not regulate nonpoint sources through permits. Nonpoint source loading is reduced using voluntary BMPs to improve land use practices that may contribute pollutant loads to impaired waters. Nonpoint source load reductions can be achieved at any location in the watershed; however, targeted projects by locally led watershed groups and local governments using a nonpoint source watershed-based plan may be more effective in restoring water quality. The Department supports the development and implementation of nonpoint source watershed-based management plans through competitive U.S. Environmental Protection Agency (EPA) funded subgrants. More information about the Department's Section 319 Nonpoint Source Implementation Program is available online at dnr.mo.gov/water/what-were-doing/nonpoint-source-pollution-section-319 or by calling 573-751-4932.

Estimates of potential nonpoint source loading are often based on available land cover data. A land cover analysis was completed for the Spring Creek TMDL using the 2011 National Land Cover Database published by the U.S. Geological Survey (USGS) (Homer et al. 2015). Land cover calculations are summarized in Table 3. Figure 3 depicts the distribution of the land coverage throughout the watershed.

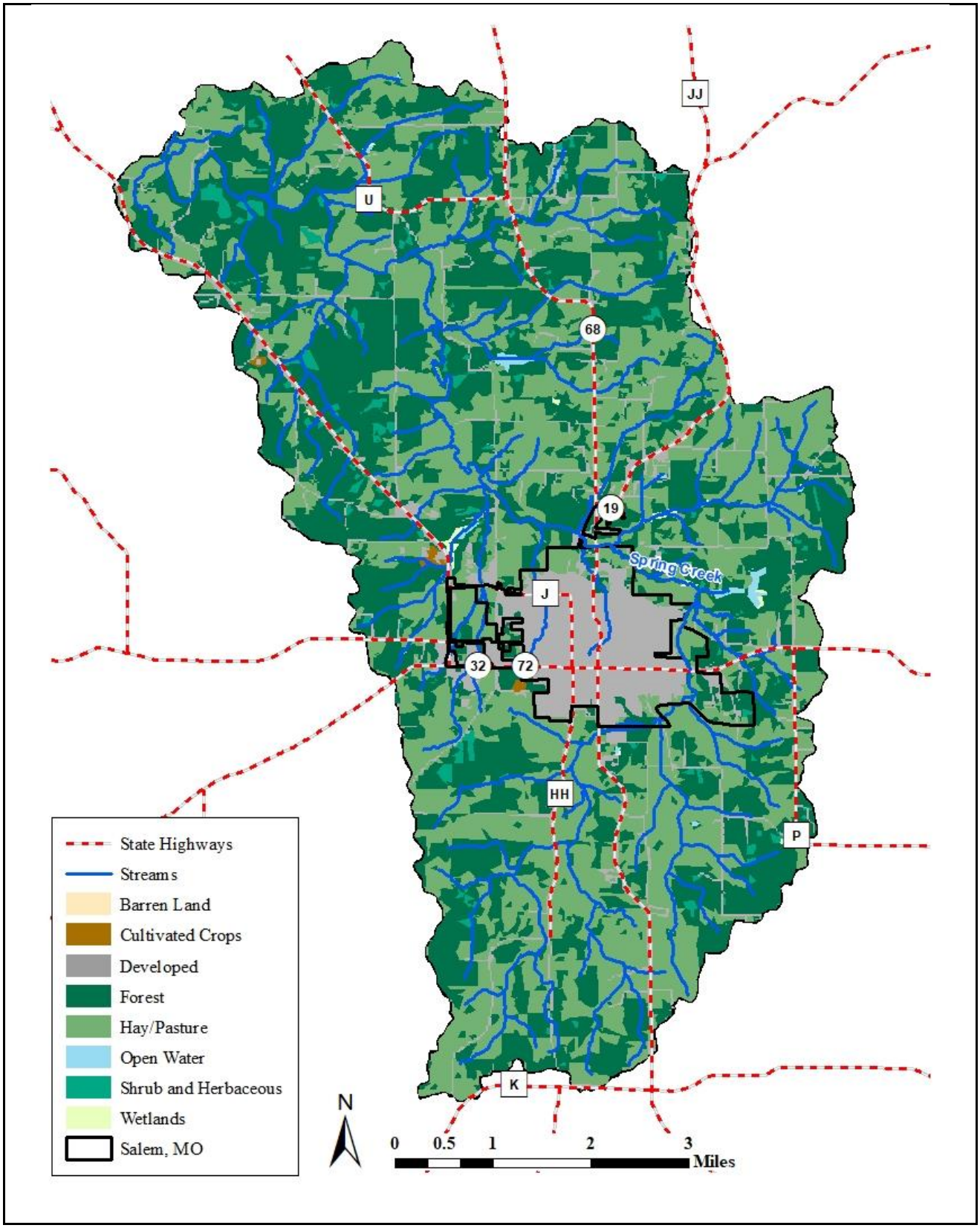

Figure 3. Land Use/Cover in the Spring Creek watershed

Table 3. Land Use and Land Cover Area in the Spring Creek Watershed (NLCD, 2011)

Land Use/Land Cover	Watershed Area		Percent
	Acres	Square Miles	
Urban	3,230	5.05	11.2%
Barren	2.29	0.004	0.0%
Cultivated Crops	39.2	0.061	0.1%
Hay/Pasture	12,895	20.1	44.8%
Forest	12,012	18.8	41.8%
Shrub and Herbaceous	430	0.672	1.5%
Wetland	54.7	0.086	0.2%
Open Water	92.9	0.145	0.3%
Total	28,755	44.9	100%

Nonpoint sources identified as potential contributors to low dissolved oxygen conditions in Spring Creek include stormwater runoff from both urban and agricultural areas, onsite wastewater treatment systems, and riparian corridor conditions. Nonpoint sources primarily contribute pollutant loads through stormwater runoff and erosion at flows influenced by precipitation events. To meet target load allocations, BMPs that reduce runoff and surface erosion are the primary means for achieving pollutant reductions from nonpoint sources. However, failing onsite wastewater treatment systems and direct waste inputs from animals that are not excluded from waterways can also contribute pollutant loading under dry conditions. Therefore, BMPs that reduce nonpoint source loading from these types of sources at lower flows may also help Spring Creek attain water quality standards.

6.2.1 Agricultural Stormwater Runoff

Background: Stormwater runoff from agricultural lands, such as pastures used for livestock grazing or croplands, may contribute pollutant loads to surface waters in the Spring Creek watersheds. Agricultural practices occurring within riparian corridors may be areas of special concern as influences to surface water quality may be more directly impacted.

Objective: The implementation of BMPs that reduce soil erosion or the movement of fertilizers and organic materials from fields or application sites will provide the greatest benefits in reducing pollutant loading from agricultural lands. Additionally, minimizing or eliminating livestock accessibility to streams can also reduce nonpoint source pollutant loading by reducing waste from being deposited directly into the waterway. Installing BMPs on highly responsive areas may produce the greatest benefit to water quality (Figure 4). The information provided by this map should be supplemented with local knowledge of the watershed in order to identify "critical areas" for BMP implementation and Section 319 funding. Until such time when critical areas have been identified, priority for BMP implementation should be given to areas identified as being highly responsive or that are within the riparian corridors of streams in the Spring Creek watershed.

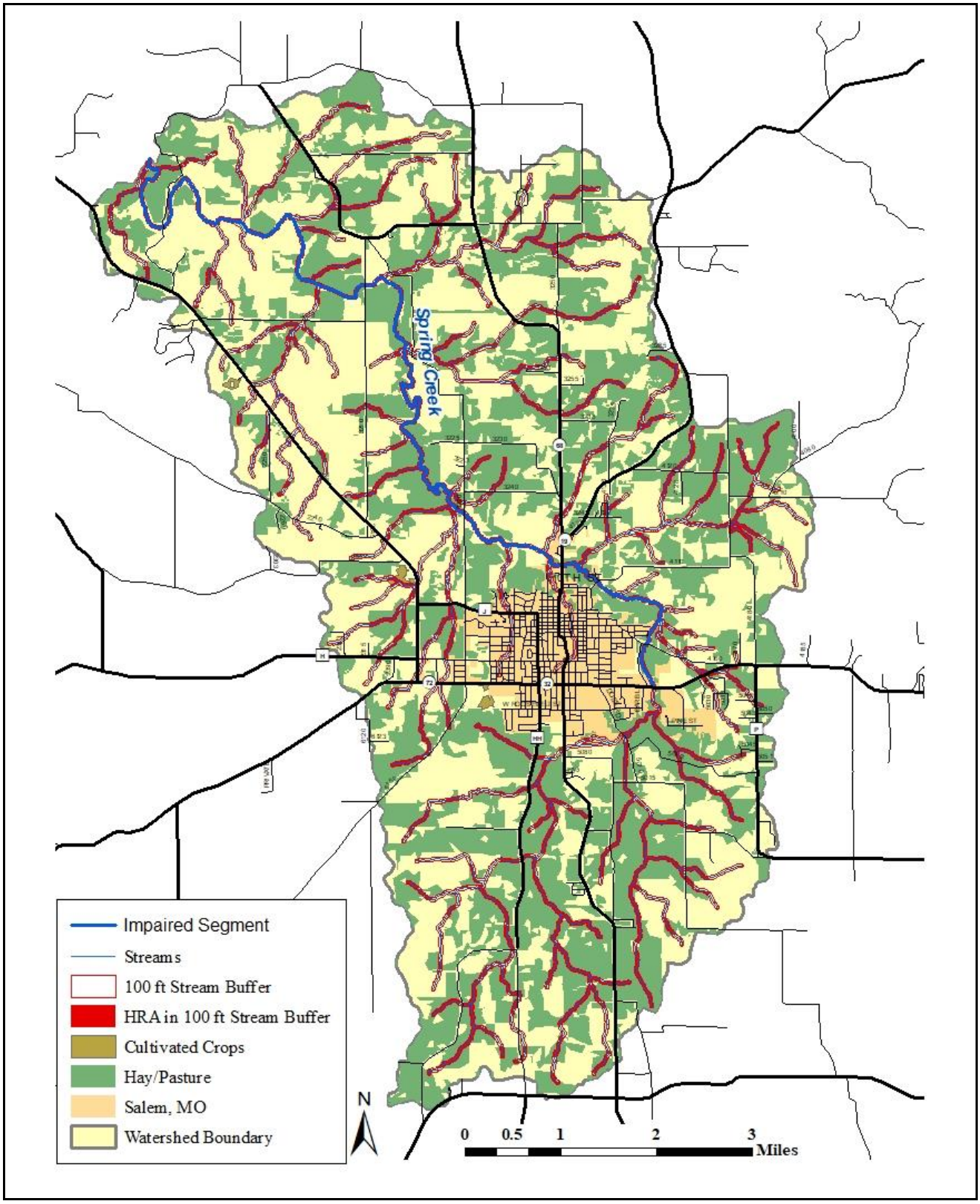

Figure 4. Agricultural areas likely to be highly responsive to BMP implementation

Strategy 1: In Missouri, the Soil and Water Conservation Program provides assistance and cost sharing opportunities to farmers and landowners willing to implement practices designed to, among other things, address grazing systems, animal waste management, soil erosion, and the protection of water quality. An online directory of the soil and water conservation districts in Missouri is available at http://mosoilandwater.land/. Table 4 presents a list of available cost-share conservation practices that may reduce sediment and nutrient loading to surface waters. Section 14 of the revised TMDL presents a list of those cost-share practices already implemented with the Spring Creek watershed.

Table 4. Soil and Water Conservation Program Cost-Share Practices that may reduce *E. coli* loading

Cost-Share No.	Practice	Mode of Action			Pollutant Addressed	
		Avoid	Control	Trap	Sediment	Nutrients
DSL-01	Permanent Vegetative Cover Establishment	x	x	x	x	x
DSL-02	Permanent Vegetative Cover Improvement	x	x	x	x	x
DSL-04	Terrace System		x	x	x	x
DSL-44	Terrace System with Tile		x		x	x
DSL-05	Diversion		x		x	x
DSL-11	Permanent Vegetative Cover - Critical Area	x	x	x	x	x
DSL-111	Permanent Vegetative Cover - Critical Area: Confined Animal Feedlot	x	x	x	x	x
DSL-15	No-Till System	x	x	x	x	x
DWC-01	Water Impoundment Reservoir		x	x	x	x
DWP-01	Sediment Retention, Erosion or Water Control Structure		x	x	x	x
DWP-03	Sod Waterway	x	x	x	x	x
N332	Contour Buffer Strips	x	x	x	x	x
N340	Cover Crop	x	x	x	x	x
N380	Windbreak/Shelterbelt Establishment	x	x	x	x	x
N410	Drop Pipe		x	x	x	x
N585	Contour Stripcropping		x	x	x	x
DSP-02	Permanent Vegetative Cover Enhancement	x	x	x	x	x
DSP 3.1	Grazing System Water Development		x		x	x
DSP 3.2	Grazing System Water Distribution		x		x	x
DSP 3.3	Grazing System Fence	x	x		x	x
DSP 3.4	Grazing System Lime		x			x
DSP 3.5	Grazing System Seed	x	x	x	x	x
N430	Irrigation Water Conveyance		x		x	x
N442	Irrigation System, Sprinkler	x			x	x
N443	Irrigation System, Surface and Subsurface		x		x	x
N447	Irrigation System, Tail Water Recovery		x		x	x
N554	Drainage Water Management		x	x	x	x
N587	Structure for Water Control		x	x	x	x
N312	Beef Waste Management System	x	x			x
N312	Dairy Waste Management System	x	x			x
N312	Poultry Waste Management	x	x			x
N312	Swine Waste Management	x	x			x
N316	Incinerator	x	x			x
N317	Composting Facility	x	x			x
N590	Nutrient Management	x	x		x	x
C650	Streambank Stabilization		x	x	x	x

Cost-Share No.	Practice	Mode of Action			Pollutant Addressed	
		Avoid	Control	Trap	Sediment	Nutrients
DSP-31	Sinkhole Improvement		x	x	x	x
BDSP-31	Buffer Sinkhole Improvement		x	x	x	x
N351	Well Decommissioning	x			x	x
N380	Windbreak/Shelterbelt Establishment	x	x	x	x	x
N386	Field Border		x	x	x	x
N391	Riparian Forest Buffer		x	x	x	x
N393	Filter Strip		x	x	x	x
N574	Spring Development	x			x	x
N725	Sinkhole Treatment	x	x	x	x	x
WQ10	Stream Protection	x	x	x	x	x

Strategy 2: Any voluntary BMP that is implemented to control erosion or limit the movement of fertilizers or animal manure from agricultural land can aid in reducing pollutant loading of nutrients or oxygen consuming substances. Table 5 presents examples of common BMPs that address agricultural runoff and where they may be used. Some of these BMPs may be similar or the same as those available through the cost-share program. BMPs placed in locally identified critical areas or in the highly responsive areas identified in this document will provide the greatest water quality benefits.

Table 5. BMPs to address agricultural runoff in the Spring Creek watershed

Best Management Practice	Description	BMP-Type
Cover crops	Vegetation planted to reduce surface erosion after harvest until the next crop	Cropland
Nutrient management plans	A plan to manage the amount, placement, and timing of applications of fertilizers	Cropland
Conservation crop rotation	Various crops grown on the same land in a planned rotation, which reduces erosion	Cropland
Grassed waterways	A grassed strip to convey water and prevent gully formation	Cropland
Terraces	An earth embankment across the slope of a field to intercept runoff and trap soil	Cropland
Vegetative Buffers	Permanently vegetated areas that reduce sediment loss	Cropland
Water retention structures	Structures to control runoff and prevent erosion	Cropland
Off-stream watering systems	Livestock watering systems located away from streams or ponds, which reduces the time livestock spend in a stream	Livestock
Rotational grazing	Rotating livestock within a pasture to spread manure more uniformly and allows vegetation to rest and regenerate	Livestock
Relocate pasture feeding sites	Move feeding sites away from streams to reduce manure near stream	Livestock
Grazing management plans	A plan designed to avoid over grazing and subsequent erosion	Livestock

Best Management Practice	Description	BMP-Type
Relocate feeding pens	Move feeding pens away from streams to reduce manure near stream	Livestock
Fence off streams and ponds	Prevent livestock from entering water ways	Livestock
Vegetative filter strips	Vegetated areas that receive runoff from crop and animal operations	Livestock

6.2.2 Urban Stormwater Runoff (Unregulated)

Background: Stormwater runoff from developed areas where impervious surfaces are common may contribute pollutant loading to surface waters. Discharges of urban stormwater that are not regulated by a municipal separate storm sewer system (MS4) permit are considered nonpoint sources.

Objective: Pollutant loading contributions from urban runoff are considered within the aggregated load allocation for nonpoint sources. Approximately 10 percent of the Spring Creek watershed is classified as urban, and this area is located adjacent to the impaired segment. For these reasons, urban stormwater runoff is considered a potentially significant contributor to the dissolved oxygen impairment in Spring Creek.

Strategy 1: Reducing overall stormwater inputs into surface waters can help reduce pollutant loading. Various BMPs and green infrastructure options exist for increasing stormwater infiltration into the ground and reducing stormwater runoff. BMP selection will be dependent upon site location, community needs, and available funding. The EPA maintains resources for urban stormwater management and green infrastructure on its website at https://www.epa.gov/green-infrastructure. Likewise, the Department maintains the *Missouri Guide to Green Infrastructure* online at dnr.mo.gov/env/wpp/stormwater/mo-gi-guide.htm.

Strategy 2: Although general reductions in stormwater are expected to aid in reducing pollutant loading, BMPs designed to address the specific pollutants of concern should be considered. The International Stormwater BMP Database, available online at bmpdatabase.org, provides information about various BMP efficiencies for reducing specific pollutants, including nutrients and sediment.

Strategy 3: Non-structural BMPs can also aid in reducing nutrient loads from urban runoff. Proper application of fertilizers to lawns reduces the potential for these nutrients to be transported by stormwater runoff. Collection and disposal of yard wastes, domestic pet waste, or backyard livestock waste (e.g., horses), prevents these organic materials from entering storm drains and surface waters. Additionally, education and outreach regarding these subjects can also result in behavioral changes that will aid in improving water quality in Spring Creek.

6.2.3 Onsite Wastewater Treatment Systems

Background: Failing onsite wastewater treatment systems (e.g., septic systems) may be sources of nutrients or oxygen demanding substances to nearby waterways during periods associated with either wet weather or dry weather flows depending upon the nature of the failure. It is unknown to what extent onsite wastewater treatment systems contribute to the impairment of Spring Creek. However, due to the location of the impairment and the availability of a sewerage system associated with the Fulton Wastewater Treatment Facility, onsite wastewater treatment systems are not expected to be a

significant contributor to the impairment. Even so, proper maintenance and operation of onsite wastewater treatment systems is likely to yield some water quality benefits.

Objective: By design, properly functioning onsite wastewater treatment systems should not be contributing significant pollutant loads to surface waters. For this reason, the TMDL assigns a load allocation of zero to these potential sources during critical low flow conditions. Proper maintenance of onsite wastewater treatment systems including septic tanks, associated drain fields, and household lagoons is the primary BMP for limiting pollutant inputs from these sources.

Strategy 1: Educate homeowners about proper onsite wastewater treatment system maintenance. This may be provided by local governments, local watershed groups, or university extension offices. The EPA maintains various guidance documents and resources pertaining to onsite treatment systems including the *Homeowner's Guide to Septic Systems* online at water.epa.gov/infrastructure/septic/homeowner-resources.cfm. For onsite wastewater treatment systems that are already failing, repair, or replacement of the system is necessary.

Strategy 2: Any local ordinances regarding permitting requirements pertaining to repairs, replacement, or the installation of new systems must be followed.

Strategy 3: Consideration should be given to reducing reliance on onsite systems in favor of centralized systems. Homeowners and local governments should explore the potential elimination of onsite systems and connection to existing sewer systems. Elimination of any onsite wastewater treatment systems in the watershed is expected to result in pollutant loading reductions.

6.2.4 Riparian Corridor Conditions

Background: Wooded riparian buffers are a vital functional component of stream ecosystems and are instrumental in the detention, removal, and assimilation of nutrients and sediment before they reach surface waters. Wooded riparian corridors can also provide shading that reduces stream temperatures, which can increase the dissolved oxygen saturation capacity of the stream. However, during some periods falling leaves may contribute organic loading to the stream and increase overall oxygen demand.

Objective: The TMDL for Spring Creek is not written to address the physical characteristics of the stream or its adjoining habitat. However, improvement or maintenance of existing riparian corridors can result in conditions that will aid the stream in achieving the applicable dissolved oxygen criterion. Note that pollutant loading from riparian areas are a component of the TMDL allocations and can be addressed appropriately through the implementation practices described in other sections of this document as they pertain to specific runoff sources, such as areas having agricultural or urban land uses.

Strategy: Establish or maintain trees and shrubs located adjacent to streams. Tree canopy cover can create shade to lower water temperatures. Cooler water can hold more dissolved oxygen than warmer water. Additionally, a forested riparian corridor can reduce the amount of sediment, organic material, and nutrients in surface runoff. Limiting the inputs of these constituents into a stream can reduce oxygen demand as well as excessive algae growth, which can also contribute to low dissolved oxygen conditions. Dominant vegetation should consist of native species that are capable of naturally regenerating and that are well suited for local soil and hydrologic conditions. The U.S. Department of

Agriculture, through the U.S. Forest Service, provides technical guidance on this strategy online at www.srs.fs.usda.gov/pubs/33522 and through the Natural Resources Conservation Service at www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/cp/ncps/.

7. Costs of Implementation and Potential Funding Sources

TMDLs are written to meet applicable water quality standards per federal regulations at 40 CFR 130.7(c)(1). As a result, they are developed without considerations of cost or available treatment technologies. However, facility upgrades and BMP installations result in real-world costs that need to be considered before determining what technologies or actions to employ in order to meet the calculated water quality targets. In many cases, TMDL implementation is partially a continuation of already permitted activities and costs are incurred as part of the normal operation and maintenance of those permitted systems. Other point source costs may arise as a result of needed facility upgrades in order to meet specified permit limits or conditions. For nonpoint sources, costs associated with installing and maintaining BMPs or with the maintenance, repair, or replacement of onsite wastewater treatment systems depend upon the type, number, and complexity of the practice or repair. Fortunately, a single BMP may address several pollutants or degradation pathways, thereby compensating for the overall costs by providing additional water quality benefits. Estimates of BMP costs are available online from the International Stormwater BMP Database at bmpdatabase.org.

To offset costs associated with facility upgrades or BMP implementation, a variety of grants and loan programs are available to assist watershed stakeholders. The most commonly used sources of funding are low-interest loans through the State Revolving Fund, Section 319 subgrants, and cost-share practices through the state's Soil and Water Conservation Program.

Low-interest loans from the Clean Water State Revolving Fund are available through the Department's Water Protection Program Financial Assistance Center. The State Revolving Fund provides subsidized loans to municipalities, counties, public sewer districts, and political subdivisions for wastewater infrastructure projects. Loans may be paired with grant funds for qualifying communities. Information on the Department's grant policy is available online at dnr.mo.gov/env/wpp/srf/wastewater-assistance.htm. Eligible projects include new construction or improvement of existing facilities. More information regarding the State Revolving Fund Program is available online at dnr.mo.gov/water/business-industry-other-entities/financial-opportunities.

The Missouri Agricultural and Small Business Development Authority (MASBDA) offers an Animal Waste Treatment System Loan Program in cooperation with the Clean Water State Revolving Fund. Animal Waste Treatment Loans Program may finance eligible animal waste treatment systems for independent livestock and poultry producers with operations of less than 1,000 animals. Eligible costs include storage structures, land, dedicated equipment, flush systems, composters, and more. More information regarding the Animal Waste Treatment Loans Program is available online at agriculture.mo.gov/abd/financial/awloanprg.php.

By amendment to the federal Clean Water Act in 1987, the Section 319 grant program was established to provide funding for efforts to reduce nonpoint source pollution. EPA provides 319 funding to the state, which in turn allocates a portion of the funding as subgrants to public and non-profit organizations to address nonpoint source concerns. Section 319-funded subgrants may be used to demonstrate innovative BMPs, support education and outreach programs, restore impaired waters, or protect waters from becoming impaired. More information regarding the Section 319 Nonpoint Source Implementation

Program is available online at dnr.mo.gov/water/what-were-doing/nonpoint-source-pollution-section-319.

The Soil and Water Conservation Program provides financial incentives to landowners to implement practices that help prevent soil erosion and protect water quality. The program offers cost-share practices through its county conservation districts. Landowners may receive up to 75 percent reimbursement of the estimated cost of a practice through the program. The primary funding for cost-share practices from the Soil and Water Conservation Program comes from the one-tenth-of-one percent Parks, Soils and Water Sales Tax. More information regarding the Soil and Water Conservation Program and cost-share practices is available online at dnr.mo.gov/land-geology/businesses-landowners-permittees/financial-technical-assistance/soil-water-conservation-cost-share-practices.

In addition to state sources of funding, federal assistance, public bonds, and private financing may also be available for TMDL implementation. For example, the U.S. Department of Agriculture through its Natural Resources Conservation Service provides various incentive and financial assistance programs for implementing BMPs that reduce pollutant loading from agricultural areas. Additionally, the EPA maintains the Catalog of Federal Funding, which is a searchable database for other financial assistance sources. Table 6 provides links to these as well as other federal funding sources.

Table 6. Online resources for potential funding sources

Name and URL	Description
U.S. Department of Agriculture Natural Resources Conservation Service https://www.nrcs.usda.gov/wps/portal/nrcs/site/mo/home/	Financial assistance and incentives to implement voluntary BMPs º Environmental Quality Incentives Program (EQIP) º Regional Conservation Partnership Program (RCPP) º Conservation Stewardship Program (CSP) º Agricultural Conservation Easement Program (ACEP)
Catalog of Federal Funding https://www.epa.gov/waterdata/catalog-federal-funding	Searchable database for financial assistance sources
Nonpoint Source – Related Funding Opportunities http://water.epa.gov/polwaste/nps/funding.cfm	List of federal websites with information regarding funding opportunities
Environmental Education Grants http://www2.epa.gov/education/environmental-education-ee-grants	Financial support for environmental education projects
Environmental Justice Grants https://www.epa.gov/environmentaljustice/environmental-justice-grants-and-resources	Grant resources for Environmental Justice communities
Water Infrastructure and Resiliency Finance Center https://www.epa.gov/waterfinancecenter	Provides financing information for drinking water, wastewater and stormwater decisions
Grants.gov http://www.grants.gov	A common website for federal agencies to post funding opportunities

8. Measurable Goals, Timeline, and Milestones

TMDL implementation uses an adaptive management process that makes progress toward achieving water quality goals while using any new information to reduce uncertainty and adjust implementation activities. Timelines and interim milestones for reaching goals are adjustable and vary depending upon the means of implementation, as well as the strategies used to address individual point or nonpoint sources.

8.1 Point Source Implementation

When appropriate, federal regulations at 40 CFR §122.47 allow a permit to specify a schedule of compliance. Any schedule of compliance included in a permit for meeting final effluent limits will serve as the primary timeline and goals for implementing the TMDL as it pertains to point source dischargers. If applicable, any schedules identified in compliance agreements, court orders, or other enforcement actions will also serve as a timeline for point source TMDL implementation.

8.2 Nonpoint Source Implementation

The inclusion of timelines, milestones, and measurable goals is a required element for watershed-based plans developed with Section 319 funding and support. Any 319-funded watershed-based management plans developed for the Spring Creek watershed or any subwatersheds therein should incorporate the goals established in the revised TMDL. These plans should also contain various milestones and implementation goals for conservation practices, as well as educational targets. Once developed, the schedules outlined in those plans will serve as a schedule for TMDL implementation as it pertains to nonpoint sources.

9. Conclusion

The purpose of this TMDL implementation strategies document is to serve as a general guide to Department staff, soil and water conservation districts, local governments, permitted entities, watershed managers, and citizen groups for reducing existing pollutant loads to restore Spring Creek to conditions that attain water quality standards. The ultimate goal is to meet Missouri Water Quality Standards through attainment of the minimum dissolved oxygen criterion for the protection of aquatic life in warm water habitats of 5 mg/L. Implementation should follow an adaptive implementation approach that makes progress toward achieving water quality goals while using new data and information to reduce uncertainty and adjust implementation activities. Implementation efforts are expected to occur over a number of years, but within the schedules established in state operating permits and Section 319 watershed-based plans. Success in achieving water quality standards will be determined by the Department through biennial assessments of water quality compliance as required by Sections 305(b) and 303(d) of the Clean Water Act.

The Department has an administrative record on file for the Spring Creek low dissolved oxygen TMDL. The record contains this implementation strategies document, the original 2010 TMDL report, the 2020 revision, and any studies, data or calculations on which loading targets are based. This information is available upon request to the Department at dnr.mo.gov/open-records-sunshine-law-requests. Any request for information about this TMDL will be processed in accordance with Missouri's Sunshine Law (Chapter 610, RSMO) and the Department's administrative policies and procedures governing Sunshine Law requests. For more information about open record/Sunshine requests, please consult the Department's website at dnr.mo.gov/open-records-sunshine-law-requests.

This implementation strategies document is scheduled for a 45-day public notice and comment period in conjunction with the comment period for the Spring Creek TMDL revision. Any comments received, as well as the Department's responses to those comments, will be maintained on file with the Department and posted online at dnr.mo.gov/water/what-were-doing/water-planning/quality-standards-impaired-waters-total-maximum-daily-loads/tmdls. The Department maintains an email distribution list for notifying subscribers of significant TMDL updates or activities. Those interested in subscribing to these TMDL updates can submit their email address using the online form at public.govdelivery.com/accounts/MODNR/subscriber/new?topic_id=MODNR_177.

10. References

FGDC (Federal Geographic Data Committee). 2003. FGDC Proposal, Version 1.1, Federal Standards for Delineation of Hydrologic Unit Boundaries. December 23, 2003.

Homer, C.G., Dewitz, J.A., Yang, L., Jin, S., Danielson, P., Xian, G., Coulston, J., Herold, N.D., Wickhm, J.D., and Megown, K., 2015, Completion of the 2011 National Land Cover Database for the conterminous United States-Representing a decade of land cover change information. Photogrammetric Engineering and Remote Sensing, v. 81, no. 5, p. 345-354.

USGS (U.S. Geological Survey). 2019. Hydrologic Unit Maps. [Online WWW] Available URL: https://water.usgs.gov/GIS/huc.html [Accessed 2019].

Appendix A
Nine Key Elements Critical to a Watershed Management Plan

a. An identification of the causes and sources or groups of similar sources that will need to be controlled to achieve the load reductions estimated in this watershed-based plan (and to achieve any other watershed goals identified in the watershed-based plan, as discussed in item (b) immediately below. Sources that need to be controlled should be identified at the significant subcategory level with estimates of the extent to which they are present in the watershed (e.g., X number of dairy cattle feedlots needing upgrading, including a rough estimate of the number of cattle per facility; Y acres of row crops needing improved nutrient management or sediment control; or Z linear miles of eroded streambank needing remediation).

b. An estimate of the load reductions expected for the management measures described under paragraph (c) below (recognizing the natural variability and the difficulty in precisely predicting the performance of management measures over time). Estimates should be provided at the same level as in item (a) above (e.g., the total load reduction expected for dairy cattle feedlots; row crops; or eroded streambanks).

c. A description of the nonpoint source management measures that will need to be implemented to achieve the load reductions estimated under paragraph (b) above (as well as to achieve other watershed goals identified in this watershed-based plan), and an identification (using a map or a description) of the critical areas in which those measures will be needed to implement this plan.

d. An estimate of the amounts of technical and financial assistance needed, associated costs, and/or the sources and authorities that will be relied upon, to implement this plan. As sources of funding, States should consider the use of their Section 319 programs, State Revolving Funds, U.S. Department of Agriculture's Environmental Quality Incentives Program and Conservation Reserve Program, and other relevant Federal, State, local and private funds that may be available to assist in implementing this plan.

e. An information/education component that will be used to enhance public understanding of the project and encourage their early and continued participation in selecting, designing, and implementing the nonpoint source management measures that will be implemented.

f. A schedule for implementing the nonpoint source management measures identified in this plan that is reasonably expeditious.

g. A description of interim, measurable milestones for determining whether nonpoint source management measures or other control actions are being implemented.

h. A set of criteria that can be used to determine whether loading reductions are being achieved over time and substantial progress is being made towards attaining water quality standards and, if not, the criteria for determining whether this watershed-based plan needs to be revised or, if a nonpoint source TMDL has been established, whether the nonpoint source TMDL needs to be revised.

i. A monitoring component to evaluate the effectiveness of the implementation efforts over time, measured against the criteria established under item (h) immediately above.